



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :

A01G 31/00

A1

(11) International Publication Number:

WO 91/08662

(43) International Publication Date:

27 June 1991 (27.06.91)

(21) International Application Number: PCT/DK90/00320

(22) International Filing Date: 7 December 1990 (07.12.90)

(30) Priority data:  
6198/89 8 December 1989 (08.12.89) DK(71) Applicant (for all designated States except US): ROCK-  
WOOL INTERNATIONAL A/S [DK/DK]; Hovedgad-  
en 501, DK-2640 Hedehusene (DK).

(72) Inventor; and

(75) Inventor/Applicant (for US only): CLAUSEN, Anders, Ulf  
[DK/DK]; Højelsesvej 18, St. Salby, DK-4600 Køge  
(DK).(74) Agent: LEHMANN & REE; Frederiksberg Alle 26, DK-  
1820 Frederiksberg C (DK).(81) Designated States: AT, AT (European patent), AU, BB, BE  
(European patent), BF (OAPI patent), BG, BJ (OAPI  
patent), BR, CA, CF (OAPI patent), CG (OAPI patent),  
CH, CH (European patent), CM (OAPI patent), DE,  
DE (European patent), DK, DK (European patent), ES,  
ES (European patent), FI, FR (European patent), GA  
(OAPI patent), GB, GB (European patent), GR (Euro-  
pean patent), HU, IT (European patent), JP, KP, KR,  
LK, LU, LU (European patent), MC, MG, ML (OAPI  
patent), MR (OAPI patent), MW, NL, NL (European  
patent), NO, RO, SD, SE, SE (European patent), SN  
(OAPI patent), SU, TD (OAPI patent), TG (OAPI pa-  
tent), US.

Published

With international search report.

(54) Title: PLANT GROWING MEDIUM CONTAINING MINERAL FIBRES

## (57) Abstract

A mineral fibre containing plant growing medium comprising lignite has ion exchange capacity and improved water reten-  
tion properties and does not require disinfection before use.

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Plant growing medium containing mineral fibres.

5 The present invention relates to a plant growing medium comprising mineral fibres and an agent for increasing the water retention ability.

10 Plant growing media containing mineral fibres may be found both in the bound form, e. g. in the form of blocks as disclosed in GB patent specification No. 1,336,426, and in the unbound form. Whether a plant growing medium is present in the bound or in the unbound form it should be porous so that sufficient water and air can be supplied for the plants to germinate and grow in the growing medium. Furthermore the growing medium should have a good water retention ability.

15 Plant growing blocks may for example be used as a germinating medium and for rooting plants under controlled growth conditions, e. g. in a greenhouse, followed by the transplantation of the blocks containing the germinated plants. In connection with the transplantation  
20 it is vital that the water retention ability of the growing medium is sufficient to avoid plant detrimental drainage.

The term "water retention ability" of a growing medium denotes both the ability to resist drainage and the water resuction ability ( the rewetting ability). In characterizing the water retention ability of  
25 a given product a so-called water retention curve is used which is determined by a measurement wherein the test medium is mounted on a support, such as sand or soil, said support having a certain depth and wherein the height level of a saturated water zone can be raised  
30 and lowered continuously. The water retention curve expresses the connection between the distance from the bottom of the medium (the top of the support) down to the surface of the underlying water saturated zone, which distance is referred to as the suction pressure in the following, and the corresponding water content in the  
35 medium. The retention curve which is a so-called hysteresis curve consists of two curve parts, namely one for increasing suction pressure (drainage) and one for decreasing suction pressure (rewetting). The hysteresis is the distance between the two curve parts measured in percent by weight or by volume of water at a given

suction pressure.

In prior art mineral fibre containing plant growing media the pore size and the variation of pore sizes generally have the effect that  
5 smaller pore size and smaller variation herein provide improved water retention and rewetting ability and lesser hysteresis.

Growing media should, however, have a certain average pore diameter and such a variation in pore sizes that a sufficient content of air  
10 and water is secured, both during the propagation phase and for a certain period following the transplantation.

Attempts have been made to use plant growing media consisting solely of mineral fibres, but such growing media have an insufficient water  
15 retention ability when transplanted to other growing media, e.g. transplantation out of doors. Thus, mineral fibre containing plant growing media which solely consist of mineral fibres will generally dry out at transplantation thus causing damage to the plants.

Furthermore, attempts have been made to increase the density of  
20 plant growing media, which consist solely of mineral fibres to achieve media having an increased water retention ability. However, such dense growing media having an increased water retention ability are too compact for plant roots to penetrate. Moreover, the  
25 hysteresis of such media is so small that the supply of air to the roots of the plants is inconveniently inhibited.

NL patent application No. 01724/88 discloses plant growing blocks comprising mineral fibres and a soil in a homogenous mixture and in  
30 such proportions that the form of the blocks is substantially maintained at any water content. These media have a good water retention ability, but they are too dense for the growing of certain plants. In addition, the soil types used are expensive and, besides, soil is associated with the disadvantage of being filled with seeds  
35 and micro-organisms that must be rendered harmless by disinfection before use, which treatment is laborious, costly, and which may under certain circumstances be hazardous to the environment.

Furthermore, attempts have been made to use mineral containing

mixtures comprising sphagnum as plant growing media, but the properties of these plant growing media vary widely because of the inhomogeneity and varied composition of sphagnum. Besides, sphagnum containing growing media suffer from the disadvantage that they do not have a lasting structure due to sphagnum being decomposed in time.

The purpose of the present invention is to provide a mineral fibre containing plant growing medium which has substantially improved water retention properties compared to known plant growing media consisting of mineral fibres and which does not require disinfection before use.

This purpose is achieved according to the invention with a plant growing medium, characterised in that it comprises lignite.

Surprisingly, it has been found that plant growing media which comprise a mixture of mineral fibres and lignite have particularly good water retention properties. Thus, when using a plant growing medium according to the invention, a water content at drainage can be achieved which at suction pressures of from about 25 cm to 150 cm that may e.g. correspond to field conditions is several times higher than the water content of a plant growing medium consisting solely of mineral fibres. Moreover, a water content several times higher than that of a rewetted plant growing medium consisting solely of mineral fibres can be achieved at rewetting.

Lignite is a brown or black carbonaceous mineral material which is formed from peat in the deeper structures of the earth's crust at moderate pressure as it is an intermediate stage between peat and coal in the process of coal formation. Lignite is an extraordinarily inexpensive resource as the deeper structures of the earth's crust contain huge reserves of this material and as it is easy to extract being found closely beneath the earth's surface in thick layers.

Water free, ash free lignite contains from about 60 to about 75 percent by weight of carbon, from about 17 to about 33 percent by weight of  $O_2$  from about 3 to about 8 percent by weight of hydrogen, from about 0.1 to about 10 percent by weight of sulphur, and from

about 0.4 to about 3 percent by weight of nitrogen. An example of a typical composition of lignite is 64 percent by weight of carbon, 5 percent by weight of hydrogen, 27 percent by weight of oxygen, 1 percent by weight of nitrogen, and 3 percent by weight of sulphur.

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Because lignite is a mineralized organic material, it contains neither seeds nor micro-organisms and consequently disinfection is not required.

- 10 Furthermore, lignite presents the advantage of retaining its hydrophilic properties, i.e. its rewetting ability, even after excessive drying out. Lignite has a very high ion exchange capacity, i. e. a good ability to adsorb nutrients in the form of ions, which is particularly advantageous when the plant growing medium is used  
15 for out-of-doors-transplantation. Besides, lignite is easy to use in the production.

- The plant growing medium according to the present invention preferably comprises from 5 to 80 percent by weight, more preferably  
20 from 20 to 50 percent by weight of lignite and preferably from 20 to 95 percent by weight, more preferably from 50 to 80 percent by weight of mineral fibres.

- The plant growing medium according to the present invention may also  
25 optionally contain clay. By the addition of clay that contains capillary pores the water retention curve is displaced further upwards, i.e. the water retention and rewetting ability is increased concurrently with the decrease of the hysteresis.

- 30 The plant growing medium contains preferably from 5 to 15 percent by weight of clay.

- In addition, the plant growing medium may optionally comprise traditionally used manufacturing agents and aids, such as binding  
35 agents, tensides, superabsorbents, and agents for controlling the air content and the water retention properties of the growing medium, such as expanded clay, foam plastic compounds, vermiculite, perlite, cellulose-containing compounds and top soil.

Most known polymers both natural polymers, such as starch, and artificially produced polymers, such as phenol formaldehyde resin may be employed as a binding agent. Phenol formaldehyde resin is preferably used.

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Traditionally employed tensides comprise, e. g. various ethylene and propylene oxide condensates.

10 The ready to use plant growing medium may be present in the bound form, such as in the form of blocks, slabs or mats, as granules or as loose crumbles, or in the unbound, loose form.

15 The term "mineral fibres" comprises rockwool fibres, slagwool fibres, and glasswool fibres plus naturally occurring fibre materials, such as wollastonite.

In the following the invention will be described in detail with reference to the following example.

20 Example

25 The water retention properties of two different plant growing blocks was determined by the determination of water retention curves for the two types of blocks. The retention curve for a given medium was determined from measurements, which was performed by placing the test object on a nivelled layer of sand, wherein the suction pressure can be regulated continuously via the height of a water saturated zone in the sandlayer.

30 One of the examined blocks consisted of 60 percent by weight of lignite, 35 percent by weight of mineral fibre, and 5 percent by weight of binding agent and the density was  $353 \text{ kg/m}^3$ , while the other block consisted solely of bound mineral fibres having a density of  $70.9 \text{ kg/m}^3$ .

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The obtained results appear from the drawing which in the form of a curve shows the connection between suction pressure and water content for the two blocks first during increasing suction pressure and then during decreasing suction pressure (two curve parts for

each block) as each curve shows an average of four measurements.

5 It is seen from the drawing that the water content of the lignite containing block compared to the block which solely consisted of mineral fibres was increased particularly at greater suction pressures, i. e. improved water retention ability, and that the lignite containing block showed much less hysteresis, i. e. an improved rewetting ability.

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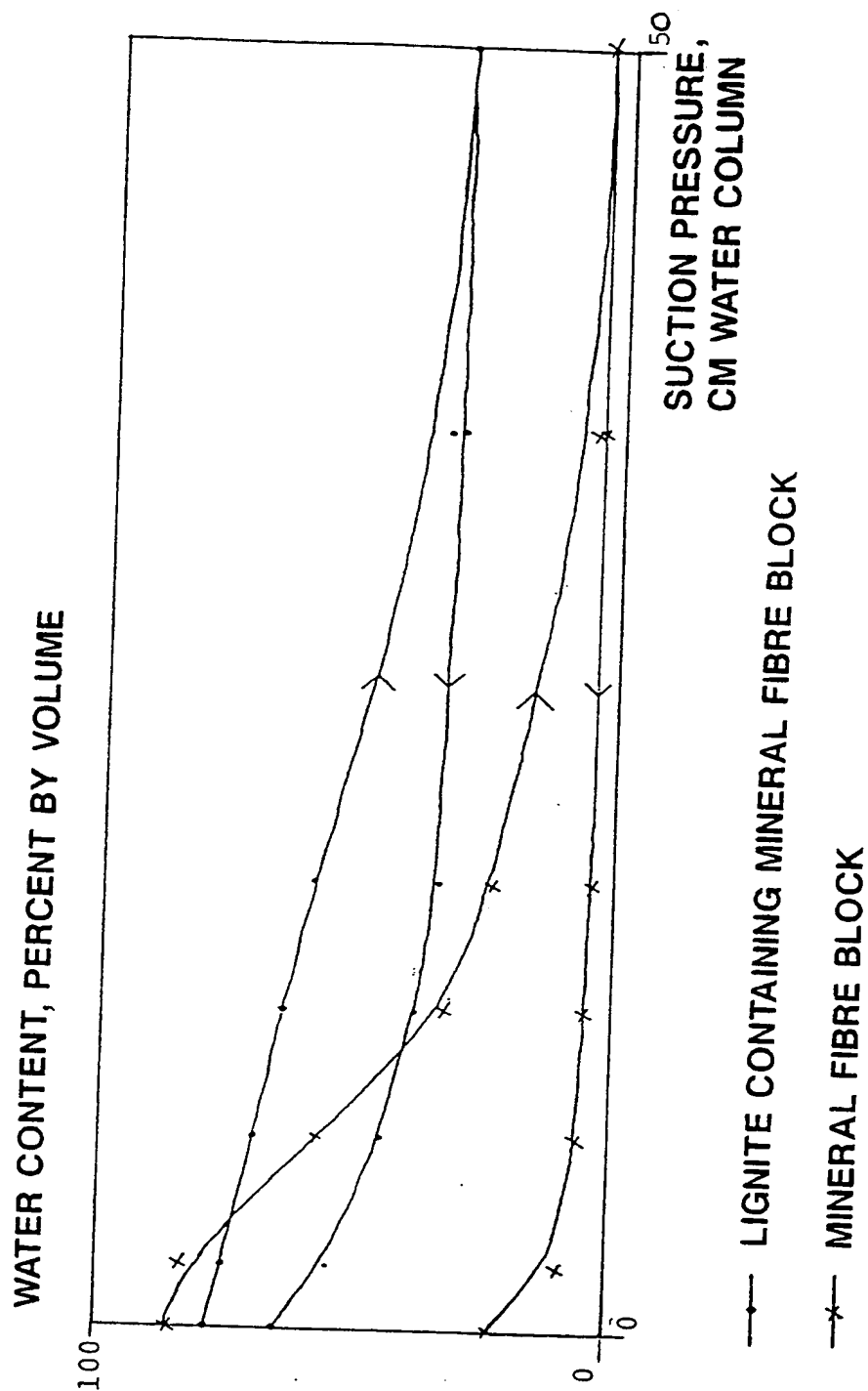
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C l a i m s

1. Plant growing medium comprising mineral fibres and an agent for the increase of the water retention ability, c h a r a c t e r -  
5 i z e d in that it comprises lignite.
2. Plant growing medium according to claim 1 ,c h a r a c t e r -  
i z e d in that it comprises from 5 to 80 percent by weight of  
lignite and from 20 to 95 percent by weight of mineral fibres.  
10
3. Plant growing medium according to claim 2, c h a r a c t e r -  
i z e d in that it comprises from 20 to 50 percent by weight of  
lignite and from 50 to 80 percent by weight of mineral fibres.
- 15 4. Plant growing medium according to any of the preceding claims,  
c h a r a c t e r i z e d in that it further comprises clay.
5. Plant growing medium according to claim 4, c h a r a c t e r -  
i z e d in that it comprises from 5 to 15 percent by weight of  
20 clay.
6. Plant growing medium according to any of the preceding claims,  
c h a r a c t e r i z e d in that it further comprises a binding  
agent.  
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7. Plant growing medium according to any of the preceding claims,  
c h a r a c t e r i z e d in that it further comprises a tenside.
8. Plant growing medium according to any of the preceding claims,  
30 c h a r a c t e r i z e d in that it further comprises a  
superabsorbent.
9. Plant growing medium according to any of the preceding claims,  
c h a r a c t e r i z e d in that it further comprises one or more  
35 agents selected from the group consisting of expanded clay, foam  
plastic compounds, vermiculite, perlite, cellulose-containing  
materials and top soil.

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# INTERNATIONAL SEARCH REPORT

International Application No PCT/DK 90/00320

## I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)<sup>6</sup>

According to International Patent Classification (IPC) or to both National Classification and IPC  
**IPC5: A 01 G 31/00**

## II. FIELDS SEARCHED

### Minimum Documentation Searched<sup>7</sup>

Classification System

Classification Symbols

IPC5

A 01 G

Documentation Searched other than Minimum Documentation  
to the Extent that such Documents are Included in Fields Searched<sup>8</sup>

SE,DK,FI,NO classes as above

## III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup>

Category *	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
A	DD, A1, 227872 (ORGREB INSTITUT FUR KRAFTWERKE) 2 October 1985, see the whole document --	1-9
A	DE, A1, 3425934 (EUFLORE GMBH FÜR GARTENBEDARF) 16 January 1986, see claims and example 1 --	1-9
A	EP, A1, 0310501 (ISOVER SAINT-GOBAIN) 5 April 1989, see the whole document -- -----	1-9

### \* Special categories of cited documents:<sup>10</sup>

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

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## IV. CERTIFICATION

Date of the Actual Completion of the International Search

19th March 1991

Date of Mailing of this International Search Report

1991 -03- 20

International Searching Authority

SWEDISH PATENT OFFICE

Signature of Authorized Officer

Ingrid Falk

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO. PCT/DK 90/00320**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the Swedish Patent Office EDP file on **91-02-28**.  
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DD-A1- 227872	85-10-02	NONE	
DE-A1- 3425934	86-01-16	NONE	
EP-A1- 0310501	89-04-05	AU-D- 2285888	89-04-06
		FR-A-B- 2621218	89-04-07
		JP-A- 1108924	89-04-26